DPP-8 [Le Chatelier Principle

Chapter: Chemical Equilibrium

"Jitna pressure life dale... utna hi strong ban jaa — Weird Chemist."

GROUP–A: Effect of Pressure / Volume

Q1: **One of the following equilibrium is not affected by change in volume of the flask [AIEEE–2002]**

(1) $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$
(2) $N_2(g) + O_2 \rightleftharpoons 2NO(g)$
(3) $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$
(4) $SO_2Cl_2(g) \rightleftharpoons SO_2(g) + Cl_2(g)$

Q2: **Which of the following equilibrium remains unaffected by a change in pressure (or volume)?**

(1) $2NOCl(g) \rightleftharpoons 2NO(g) + Cl_2(g)$
(2) $H_2(g) + CO_2(g) \rightleftharpoons H_2O(g) + CO(g)$
(3) $3PbS(s) + 3O_2(g) \rightleftharpoons 2PbO(s) + 2SO_2(g)$
(4) $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$

Q3: **Which reaction yields is unaffected by high pressure?**

(1) $PCl_3 + Cl_2 \rightleftharpoons PCl_5$
(2) $N_2 + O_2 \rightleftharpoons 2NO$
(3) $N_2 + 3H_2 \rightleftharpoons 2NH_3$
(4) $2SO_2 + O_2 \rightleftharpoons 2SO_3$

Q4: **In which equilibrium reaction does decreasing pressure shift equilibrium to the right?**

(1) $N_2 + 3H_2 \rightleftharpoons 2NH_3$
(2) $H_2 + I_2 \rightleftharpoons 2HI$
(3) $N_2O_4 \rightleftharpoons 2NO_2$
(4) $H_2 + Cl_2 \rightleftharpoons 2HCl$

Q5: **What happens to equilibrium $SO_2(g) + \frac{1}{2}O_2(g) \rightleftharpoons SO_3(g)$ + heat when pressure temperature both increased?**

(1) Forward increases
(2) Backward increases
(3) Backward decreases
(4) No change

Q6: **In which reaction equilibrium moves to left side when pressure is increased :-**

(1) $H_2 + Cl_2 \rightleftharpoons 2HCl$
(2) $2Mg(s) + O_2(g) \rightleftharpoons 2MgO(s)$
(3) $2H_2O \rightleftharpoons 2H_2 + O_2$
(4) $N_2 + 3H_2 \rightleftharpoons 2NH_3$

Q7: **A reaction in equilibrium: $2A(g) + 3B(g) \rightleftharpoons 3C(g) + D(g) + Q$ If pressure is reduced to half :-**

(1) The amounts of C and D increase
(2) The amounts of C and D increase
(3) The amount of D decreases
(4) All remain constant

Q8: **Does Le Chatelier predict change if gas mixture is compressed? $N_2O_4 \rightleftharpoons 2NO_2$**

(1) Backward favoured
(2) Forward favoured
(3) No change
(4) No information

GROUP–B: Effect of Temperature, Pressure,Volume,Conc.

Q9: **Which of the following conditions should be more favourable for increasing the rate of forward reaction in the equilibrium $H_2 \rightleftharpoons H + H$ ($\Delta H = +ve$) ?**

(1) 2000°C temperature and 760 mm of Hg pressure.
(2) 3500°C temperature and 100 cm of Hg pressure.
(3) 3500°C temperature and 1 mm of Hg pressure.
(4) All are wrong.

Q10: **The equilibrium $2SO_2(g) + O_2(g) \rightleftharpoons 2\ SO_3(g)$; $\Delta H° = -198$ kJ Condition favourable for forward reaction is –** **[AIEEE–2003]**

(1) Lowering the temperature and increasing the pressure
(2) Any value of temperature as well as pressure
(3) Lowering of temperature as well as pressure
(4) Increasing temperature as well as pressure

Q11: **Which one condition will favour maximum formation of product in $A_2(g)+B_2(g) \rightleftharpoons X_2(g)$; $\Delta H = -X$ kJ ?**

(1) Low temperature and high pressure
(2) Low temperature and low pressure
(3) High temperature and high pressure
(4) High temperature and low pressure

Q12: **For the reversible reaction : $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g) + Heat$ The equilibrium shifts in forward direction :**

(1) By increasing the concentration of $NH_3(g)$
(2) By decreasing the pressure
(3) By decreasing the concentrations of $N_2(g)$ and $H_2(g)$
(4) By increasing pressure and decreasing temperature

Q13: **The oxidation of SO_2 by O_2 to SO_3 is exothermic. The yield of SO_3 will be minimum if :-**

(1) Temperature is increased and pressure kept constant
(2) Temperature reduced and pressure increased
(3) Both temperature and pressure increased
(4) Both temperature and pressure decreased

Q14: **$aA \rightleftharpoons bB + cC$, $\Delta H = -$ x kcal. If high pressure and low temperature are favourable for products, hence :-**

(1) $a > b + c$
(2) $a < b + c$
(3) $a = b + c$
(4) None of them

Q15: **For the manufacture of ammonia by the reaction – $N_2 + 3H_2 \rightleftharpoons 2NH_3 + 21.9$ kcal, the favourable conditions are :-**

(1) Low temperature, low pressure catalyst
(2) Low temperature, high pressure catalyst
(3) High temperature, low pressure catalyst
(4) High temperature, high pressure catalyst

Q16: **In manufacture of NO, the reaction of N_2 and O_2 to form NO is favourable if :-**

(1) Pressure is increased
(2) Pressure is decreased
(3) Temperature is increased
(4) Temperature is decreased

Q17: **For the reversible reaction : $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g) +$ Heat The equilibrium shifts in forward direction :**

(1) By increasing the concentration of $NH_3(g)$
(2) By decreasing the pressure
(3) By decreasing the concentrations of $N_2(g)$ and $H_2(g)$
(4) By increasing pressure and decreasing temperature

Q18: **Which condition favours maximum formation of product in $A_2(g) + B_2(g) \rightleftharpoons X_2(g)$; $\Delta H = -X$ kJ ?**

(1) Low temperature and high pressure
(2) Low temperature and low pressure
(3) High temperature and high pressure
(4) High temperature and low pressure

Q19: **The reaction $SO_2(g) + \frac{1}{2}O_2(g) \rightleftharpoons SO_3(g) +$ heat. What happens when both pressure and temperature are increased?**

(1) Forward reaction increases
(2) Backward increases
(3) Backward decreases
(4) No change

Q20: **When $NaNO_3$ is heated in a closed vessel, O_2 is liberated. At equilibrium :**

(1) Addition of $NaNO_3$ favours forward reaction
(2) Addition of $NaNO_2$ favours reverse reaction
(3) Increasing pressure favours reverse reaction
(4) Decreasing temperature favours forward reaction

Q21: **In the reaction $2A(g) + B(g) \rightleftharpoons C(g) + 362$ kcal Highest yield of C occurs at :**

(1) 1000 atm and 500°C
(2) 500 atm and 500°C
(3) 1000 atm and 50°C

(4) 500 atm and 100°C

Q22: $K_p \rightarrow 10^{-2} \rightarrow 10^{-3}$ Temperature $\rightarrow$ 400K $\rightarrow$ 450K What would you consider by above information :-

(1) Equilibrium constant increases with increase in concentration
(2) More molecules form on left hand side
(3) Energy is released
(4) None

Q23: Increase in temperature in a reversible equilibrium reaction favours –

(1) Forward reaction only
(2) Backward reaction only
(3) Either forward or backward reaction
(4) Neither forward nor backward reaction

GROUP–C: Effect of Inert Gas (Constant P / Constant V)

Q24: Consider the following equilibrium system; $2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$; some inert gas is added at constant volume. Predict which of the following is true?

(1) More of SO_3 is produced.
(2) Less SO_2 is produced.
(3) Addition of inert gas does not affect equilibrium.
(4) System moves to a new equilibrium position which cannot be predicted.

Q25: Consider the equilibrium system; $SO_2(g) + \frac{1}{2}O_2(g) \rightleftharpoons SO_3(g)$; set up in a cylinder fitted with a piston. Some inert gas is added and piston moved outward to keep total pressure constant.

(1) Addition of inert gas does not affect equilibrium.
(2) Less SO_3 is produced.
(3) More SO_3 is produced.
(4) Cannot be predicted theoretically.

Q26: In a vessel containing SO_3, SO_2 and O_2 at equilibrium, some helium gas is introduced so that total pressure increases while temperature and volume remain constant. According to Le-Chatelier principle, dissociation of SO_3 :

(1) Increases
(2) Decreases
(3) Remains unaltered
(4) None of these

Q27: For the reaction $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$, forward reaction at constant T is favoured by :

(a) Introducing inert gas at constant volume
(b) Introducing chlorine at constant volume
(c) Introducing inert gas at constant pressure
(d) Increasing volume
(e) Introducing PCl_5 at constant volume

(1) a, b, c

(2) b, c, d
(3) c, d, e
(4) a, c, d, e

Q28: The effect of adding krypton (Kr) gas on equilibrium position at constant volume is :-
(1) If $\Delta n = 0$, backward reaction is favoured.
(2) If $\Delta n = +$ve, forward reaction is favoured.
(3) If $\Delta n = -$ve , forward reaction is favoured.
(4) No effect whatever be the value of Δn

GROUP–D: Assertion–Reason

Q29: Assertion: For a reversible exothermic reaction, extent of reaction decreases with increase in temperature. Reason: Temperature is favourable for more formation of product.
(1) A
(2) B
(3) C
(4) D

Q30: Assertion: $SO_2 + \frac{1}{2}O_2 \rightleftharpoons SO_3$ + heat ; Forward reaction favoured at low T and high P. Reason: Reaction is endothermic.
(1) A
(2) B
(3) C
(4) D

Q31: Assertion: No effect on equilibrium constant when inert gas added. Reason: Equilibrium constant changes only with temperature.
(1) A
(2) B
(3) C
(4) D

GROUP–G: Mixed Le–Chatelier / Conceptual

Q32: The reaction $CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$ goes to completion in lime kiln because :
(1) of the high temperature
(2) CaO is more stable than $CaCO_3$
(3) CaO is not dissociated
(4) CO_2 escapes continuously

Q33: Cis–2–pentene $\rightleftharpoons$ Trans–2–pentene, $\Delta G^\circ = -3.67$ kJ. If excess trans form is added :-
(1) More trans forms
(2) More cis forms
(3) Forward reaction proceeds

(4) Equilibrium unchanged

Q34: For reaction aA $\rightleftharpoons$ ℓL + mM. If sudden volume increase decreases degree of dissociation, then :

(1) a $< \ell + m$

(2) a $= \ell + m$

(3) a $= \ell - m$

(4) a $> \ell + m$

Q35: At constant temperature in a closed container $CaCO_3$ was decomposed $CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$. Which of the following will give change in pressure?

(1) Size of container

(2) Temperature

(3) Addition of CaO

(4) Amount of $CaCO_3$

Q36: At equilibrium 500mL vessel contains 1.5 M A, B, C, D. If 0.5M of C and D are removed, what will be K_c for A + B $\rightleftharpoons$ C + D ?

(1) 1

(2) $\frac{1}{9}$

(3) $\frac{4}{9}$

(4) $\frac{5}{9}$

Q37: A 20 L container at 400 K contains CO_2 at 0.4 atm and excess SrO. If container volume is reduced, maximum volume when CO_2 pressure becomes maximum is (Kp = 1.6 atm):

(1) 10 L

(2) 4 L

(3) 2 L

(4) 5 L

Q38: For the reaction $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$ the degree of dissociation varies inversely as $\sqrt{p}$. If volume is increased 16 times, the new degree of dissociation becomes :

(1) 4 times

(2) $\frac{1}{4}$ times

(3) 2 times

(4) 1 time

Q39: In system $A(s) \rightleftharpoons 2B(g) + 3C(g)$, if concentration of C is doubled, then concentration of B becomes :

(1) Double of original

(2) Half of original

(3) $2\sqrt{2}$ times original

(4) $\frac{1}{2\sqrt{2}}$ times original

Q40: In reaction $Fe(OH)_3(s) \rightleftharpoons Fe^{3+} + 3OH^-$, if $[OH^-]$ decreases to $\frac{1}{4}$, then equilibrium $[Fe^{3+}]$ increases upto :

(1) 16 times

(2) 64 times

(3) 4 times
(4) 8 times

Q41: In the reaction $PCl_5 \rightleftharpoons PCl_3 + Cl_2$ the partial pressure of PCl_3, Cl_2 and PCl_5 are 0.3, 0.2 and 0.6 atm respectively at equilibrium. If partial pressure of PCl_3 and Cl_2 was increased twice, what will be the partial pressure of PCl_5 in atm at new equilibrium condition :-

(1) 0.3
(2) 1.2
(3) 2.4
(4) 0.15

GROUP–D: Solubility / Phase Equilibrium

Q42: Which of the following is correct regarding gas–solution equilibrium?

(1) Solubility of dissolved gas increases with pressure and decreases with temperature.
(2) Increases with pressure and temperature both.
(3) Decreases with pressure and increases with temperature.
(4) Decreases with pressure and temperature both.

Q43: On cooling of following system at equilibrium $CO_2(s) \rightleftharpoons CO_2(g)$:-

(1) No effect on equilibrium
(2) More gas is formed
(3) More gas solidifies
(4) None

Q44: On applying pressure to the equilibrium ice $\rightleftharpoons$ water, which phenomenon will happen :

(1) More ice will be formed
(2) More water will be formed
(3) Equilibrium will not be disturbed
(4) Water will evaporate

Q45: At constant temperature on increasing pressure which is correct :-

(1) Solid$\rightleftharpoons$Liquid : more liquid formed
(2) NH_3 formation decreases
(3) $CO_2 + C \rightleftharpoons 2CO$ shifts forward
(4) Solubility of gas in liquid increases